Steady f-plane circulation in basins with saddle-point bathymetry

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Nilsson, Walin, and Broström [1] have recently shown how a velocity field in geostrophic and hydrostatic balance in an f-plane may be diagnosed from prescribed distributions of buoyancy and wind stress, in a basin with closed isobaths. I extend their analysis to cover basins with more complex depth contours, treating in particular the behavior of the flow in the neighbourhood of a saddle point, where the depth H is given by $H = H_0 + Axy$. We find that the asymptotic behaviour of the flow field in the limit of large $|x|$ and $|y|$ may be specified independently in each of the four quadrants separated by the x and y axes. Hence, discontinuities in the flow velocity across saddle-point separatrices, which may be predicted by the integral constraint formulae of Nilsson *et al.*, can be matched asymptotically across internal boundary layers.

Reference

[1] J. Nilsson, G. Walin, and G. Broström: Steady f-plane circulation arising from a prescribed buoyancy distribution in basins with sloping boundaries; or the role of bottom friction for creating a thermohaline circulation. Submitted to *Journal of Marine Research*, September 2004. URL: http://www.misu.su.se/~nilsson/